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**A Department of Energy
Environmental Cleanup Program**

Environmental Restoration Project Standard Operating Procedure

for:

Water-Level Measurement

☒ **NES Approved**

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Water-Level Measurement

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Water-Level Measurement

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the method for determining the depth to groundwater in an open borehole, cased monitor well, or piezometer for the Environmental Restoration (ER) Project.

2.0 SCOPE

This SOP is a mandatory document and shall be implemented by all ER Project participants when water-level measurements are obtained for the ER Project.

3.0 TRAINING

- 3.1 All users of this SOP are trained by reading the procedure, and the training is documented in accordance with QP-02.02.
- 3.2 The Field Team Leader (FTL) shall monitor the proper implementation of this procedure and ensures that relevant team members have completed all applicable training assignments in accordance with QP-02.02.

4.0 DEFINITIONS

Note: A glossary of definitions can be located on the ER Project internal homepage <http://erinternal.lanl.gov>.

- 4.1 Piezometer— An observation well with a short screen at the bottom used to access groundwater. Usually used to measure head at a point in a saturated zone. If the screen straddles the top of an unconfined saturated zone, the position of the water table is obtained.
- 4.2 Potentiometric surface— Level at which water stands in wells; also water table or piezometric surface. Water level depends on the depth of the screen in the saturated zone.
- 4.3 Site-Specific Health and Safety Plan (SSHASP)—A health and safety plan that is specific to a site or ER-related field activity that has been approved by an ER health and safety representative. This document contains information specific to the project including scope of work, relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

5.0 BACKGROUND AND PRECAUTIONS

- 5.1 This SOP shall be used in conjunction with an approved SSHASP. Also, consult the SSHASP for information on and use of all PPE.

- 5.2 Water-level measurements are generally used to construct potentiometric-surface maps. Water-level data are also used to determine groundwater flow direction, hydraulic gradients, impacts due to pumping or other aquifer stresses as well as hydraulic conductivity and flow velocity.
- 5.3 The documentation of water-level measurements, air quality for the health and safety of field personnel, and equipment calibration will be performed as described in the associated SOPs. Refer to the site-specific work plan for more information on the scope of work activities, equipment, and frequency of measurements.
- 5.4 Water-level measurements from boreholes, piezometers, or monitor wells across an area should be obtained in less than a 24-hour period or within as short a period of time as possible. Under some conditions all measurements must be taken within a shorter time interval or simultaneously. The following conditions require measurements to be taken within a shorter time period:
- If the difference in water levels between adjacent wells is too large to be due to the natural hydraulic gradient or well-depth differences
 - If drastic atmospheric pressure changes occur within the monitoring period
 - If the saturated zone is affected by water levels in a nearby river, impoundment, or unlined ditch
 - If the saturated zone is stressed by intermittent pumping of production wells
 - If the saturated zone is being actively recharged because of a precipitation event
- 5.5 Allow water levels in piezometers and monitor wells to stabilize for a minimum of 24 hours after well construction and development before measurements are taken. Repeat measurements periodically to determine if a static water level has been achieved. Recovery may take longer in wells completed in tight formations.

6.0 RESPONSIBLE PERSONNEL

The following personnel are responsible for activities identified in this SOP:

- 6.1 Focus Area Leader
- 6.2 Team Leader
- 6.3 Quality Program Project Leader
- 6.4 Author
- 6.5 ER Project personnel

7.0 EQUIPMENT

A checklist of suggested equipment and supplies needed to implement this procedure is provided in Attachment A. The device used to measure water levels should be adequate to attain an accuracy of 0.01 ft. Generally acceptable devices are listed below.

- 7.1 Electric water-level meter — A flat graduated tape attached to a stainless steel probe containing an electrode, which emits an audible and visible signal when contact with water is made. This is the most common and preferred manual device.
- 7.2 Flame ionization detector (FID) — A portable air-monitoring instrument that functions as a non-specific total hydrocarbon analyzer. In the gas chromatograph mode, an FID provides tentative qualitative/quantitative vapor identification.
- 7.3 Photoionization detector (PID) — A portable monitoring instrument used to detect the concentrations of organic and some inorganic gases in air. The vapor concentrations detected are non-specific as to compound species. A PID is used (1) to protect the health and safety of field personnel and (2) for field screening to select which samples will be sent for laboratory analysis.
- 7.4 Popper — A popper is a metal cylinder with a concave undersurface that is attached to the end of a steel tape. The cylinder makes an audible “pop” when it hits the water allowing the distance to the water surface to be determined on the tape.
- 7.5 Pressure Transducer — An electronic probe connected to a wire cable that is lowered into the water column of a well to measure pressure. The pressure measured is the total pressure, which includes both the hydrostatic pressure of the fluid column above the transducer and the atmospheric pressure at the fluid surface. Changes in head are proportional to changes in the height of the water column or water-level. Pressure transducers are designed to be used with electronic data-logging instruments and send a current to the data logger. The current is proportional to the pressure and can be converted to meaningful units by the data logger.
- 7.6 Steel tape and chalk — This equipment includes a graduated steel tape with a weight attached to its end used to measure DTW. The graduations on the end of the tape are coated with chalk and the tape is lowered into the well until the lower part of the tape is submerged in water. The total tape in the well is noted and the tape is withdrawn. The change in color of the chalk coating indicates the position of the water surface. The length of wet tape is subtracted from total tape length to determine depth to water.

8.0 PROCEDURE

Note: Subcontractors performing work under the ER Project’s quality program may follow this SOP for water-level measurement. Subcontractors may use their own procedure(s) as long as the substitute procedures meet requirements prescribed by

the ER Project Quality Management Plan, and have been approved by the ER Project's Quality Program Project Leader (QPPL) before starting the activity(s).

Note: ER Project personnel may produce paper copies of this procedure printed from the controlled-document electronic file located at website http://erinternal.lanl.gov/home_links/Library_proc.htm. However, it is their responsibility to ensure that they are properly trained and are utilizing the current version of this procedure. The author may be contacted if text is unclear.

Note: Deviations from SOPs are made in accordance with QP-04.02, Standard Operating Procedure Development and documented in accordance with QP-05.07, Notebook Documentation for Environmental Restoration Technical Activities.

8.1 Pre-operation Activities

- 8.1.1 When planning to collect water-level measurements from a number of wells, it is prudent to start with those wells that are the least contaminated and proceed toward wells having increasing levels of contamination. A review of the most current water quality data for the wells of interest should be conducted in order to plan the water-level measuring event.
- 8.1.2 Calibrate and check equipment before leaving for the field. Use the same measuring device each time to ensure accuracy.
- 8.1.3 In general, keep measuring equipment clean so that it cannot be the means of introducing dirt or contaminants into a well or piezometer. Decontaminate all equipment that will be used inside the first well to be measured in accordance with SOP-01.08, Field Decontamination of Drilling and Sampling Equipment. Throughout the event, systematically continue to decontaminate equipment prior to entering any new well.
- 8.1.4 Preplan the event using existing maps to locate the monitor wells to be measured on maps. Ensure that access is cleared to all well sites. Acquire keys to locked gates as needed.

8.2 Manual Water-level Measurement Procedures

- 8.2.1 Upon approaching the first well, unlock the protective steel well-head cover and remove the well cap. Note the well ID, date and time of day in the field notebook and on the Water-Level Elevation Data Sheet (Attachment B). Allow the well to equilibrate to atmospheric pressure. If required by site-specific conditions, monitor the headspace of the well with a photoionization detector (PID) or a flame ionization detector (FID) to determine the presence of volatile organic compounds and record the measurements in the field notebook.
- 8.2.2 Lower an electric water-level meter or equivalent (for instance, permanently installed transducers or popper) into the well until the water surface is encountered.

- 8.2.3 Measure the depth to water (DTW), defined as the distance from the water surface to the measuring point. Commonly, a surveyed measuring point is prominently marked at the top of the well casing. If a surveyed measuring point does not exist, place a mark on the casing as a reference measuring point. The mark should be permanent; a groove cut with a file is recommended. If the measuring point is missing or unknown, record the reference point from which the measurement was made. Repeat the DTW readings until results are reproduced at least three times. Record the final measurement, well number, and measuring date and time Water-level Elevation. Record water-level elevation in feet above msl, computed as: $WLE = MPE - DTW$, on the Water-Elevation Data Sheet (Attachment B).
- 8.2.4 Reel in the water-level meter tape and remove it from the well. Replace the well cap and secure the locking protective well-head cover.
- 8.2.5 Decontaminate the down-hole equipment and store it appropriately for transport to the next well site.
- 8.2.6 Note and record in the field notebook any physical changes (like erosion or cracks) in the protective concrete pad or variation in the total depth of the well.
- 8.2.7 Enter water-level measurements and appropriate data from the field notebook onto the Water-Level Elevation Data Sheet (Attachment B). Fill out the forms as described in Attachment C, Water-level Elevation Data Sheet Completion Guidance.

8.3 Pressure Transducer Water-level Measurement

When using pressure transducers to measure water levels, refer to procedures listed in SOP-07.01, Pressure Transducers.

8.4 Post-operation Activities

- 8.4.1 Complete all data collection forms and sign all pages.
- 8.4.2 Draw a line under last entry on the Water-Level Elevation form and initial it to indicate the end of record.

8.5 Lessons Learned

During the performance of work, ER Project personnel shall identify, document and submit lessons learned in accordance with QP-03.02, Lessons Learned. This QP can be located at website: http://erinternal.lanl.gov/home_links/Library_proc.htm.

9.0 REFERENCES

ER Project personnel may locate the ER Project Quality Management Plan/ER Project QP requirements crosswalk at website:

http://erinternal.lanl.gov/home_links/Library_proc.htm.

The following documents are cited within this procedure.

QP-02.02, Personnel Orientation and Training

QP-03.2, Lessons Learned

QP-04.02, Standard Operating Procedure Development

QP-04.04, Record Transmittal to the Records Processing Facility

QP-05.07, Notebook Documentation for Environmental Restoration Technical Activities

SOP-01.04, Sample Control and Field Documentation

SOP-01.06, Management of Environmental Restoration Project Wastes

SOP-01.08, Field Decontamination of Drilling and Sampling Equipment

SOP-07.01, Pressure Transducers

EPA. 1986, *RCRA Groundwater Monitoring Technical Enforcement Guidance Document." U.S. Environmental Protection Agency unnumbered document. U.S. Government Printing Office, Washington, D.C.

Heath, R.C., 1983, "Basic Ground-Water Hydrology." US Geological Survey Paper 2220.

Sweet, H.R., Rosenthal, G., and Atwood, D.F., 1990, Water-Level Monitoring – Achievable Accuracy and Precision; in Ground Water and Vadose Zone Monitoring, D.M. Nielsen and A.I. Johnson, Editors, ASTM STP#1053, ASTM, Philadelphia, PA, pp. 193 – 209.

10.0 RECORDS

The FTL is responsible for submitting the following records (processed in accordance with QP-4.4, Record Transmittal to the Records Processing Facility) to the Records Processing Facility:

10.1 Completed Water-Level Elevation Data Sheet (Attachment B)

10.2 Daily Activity Log form or field notebook (Attachment E in SOP-01.04)

11.0 ATTACHMENTS

The ER project personnel may employ documentation formats different from those attached to/named in this SOP provided that the substituted forms include the information required in the official forms.

Attachment A — Equipment and Supplies Checklist (1 page)

Attachment B — Water-Level Elevation Data Sheet (1 page)

Attachment C — Water-Level Elevation Data Sheet Completion Guidelines (1 page)

[Using a token card, click here to record "self-study" training to this procedure.](#)

If you do not possess a token card or encounter problems, contact the RRES-ECR training specialist.

Equipment and Supplies Checklist for Water-level Measurement

- _____ Well location map
- _____ Keys to well locks and access gates
- _____ Water-level meter
- _____ Steel tape and chalk
- _____ Popper
- _____ Pressure transducer
- _____ Decontamination equipment
- _____ Duct tape
- _____ De-ionized water
- _____ Field notebook
- _____ Waterproof pen
- _____ Groundwater elevation forms
- _____ Daily Activity Logs
- _____ Any PPE listed or required in the SSHASP
- _____ Any additional supplies listed in associated procedures, as needed

Photoionization detector (PID)

- _____ Flame ionization detector (FID)

SOP-07.02

Los Alamos
Environmental Restoration Project

Los Alamos National Laboratory Environmental Restoration Project

WATER-LEVEL ELEVATION DATA SHEET

Field Area _____ Measured by (print name): _____ Signature: _____ Sheet ____ of ____									
Well ID	Date	Time	Measuring Point Description	MPE, Measuring Point Elevation (ft above MSL)	DTW, Depth to Water (ft)	Water-level Elevation (ft above MSL)	Length of measuring Point to Ground Surface (ft)	Depth to Water/ BGS (ft)	Comments

WATER-LEVEL ELEVATION DATA SHEET

COMPLETION GUIDELINES

Use an indelible dark ink pen. Make an entry in each blank. Where there is no data entry, enter UNK for Unknown, NA for Not Applicable, or ND for Not Done, etc. To change an entry, draw a single line through it, add the correct information above it, and date and initial the change. For all Water-level Elevation forms, complete the following information:

1. Field Area. List the two-digit Technical Area (TA) number, Canyon, PRS, as appropriate, in which the water-level measurements are being collected.
2. Measured by/signature. Print name of ER team member measuring water levels and sign document.
3. Sheet Number. Number all the sheets that are used for this activity, by day or by some practical unit.
4. Well ID. List well number or designation.
5. Log Date and Time. The date and time when the measurement was made, in the following formats: DD-MMM-YY (e.g., 01-Jan-91), and the 24-hour clock time (e.g., 0837 for 837 a.m. and 1912 for 7:12 p.m.).
6. Measuring Point Description. Describe the reference point from which the water-level measurement was made (e.g., top of casing [TOC], survey marker, filed notch in casing, etc.)
7. MPE (Measuring Point Elevation). List surveyed elevation in feet above mean sea level (msl).
8. DTW (Depth to Water). Record measured depth to water, or distance from groundwater surface to measuring point to the nearest hundredth of a foot.
9. Water-level Elevation. Record water-level elevation in feet above msl, computed as: $WLE = MPE - DTW$.
10. Length (L) of Measuring Point to Ground Surface. Measure and record the vertical distance from ground surface to designated measuring point. If the measuring point is identical to the top of casing, this length is called the well stickup.
11. Depth to Water/BGS (i.e., below ground surface). Computed as $DTW/BGS = MPE - L - DTW$.
12. Comments. Record any observations having to do with abnormal site conditions, well-head security issues, well maintenance issues, etc.